

PALEONTOLOGICAL EVIDENCE CONCERNING
SOME POST GLACIAL FEATURES OF
THE MISSISSIPPI RIVER VALLEY

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The Science Museum

SCIENTIFIC PUBLICATIONS OF THE
THE SCIENCE MUSEUM
New Series Vol. 1. - No. 2

THE SCIENCE MUSEUM
Saint Paul, Minnesota 55101
February 1967

Library of Congress Catalog Card Number: 67-17462

Published by THE SCIENCE MUSEUM

St. Paul, Minnesota 55101

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Price 35¢

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A section of the present valley of the Mississippi River within the Twin Cities, Minnesota, between Fort Snelling and the waterfalls called Saint Anthony, is a steep-sided gorge about a quarter of a mile wide and 100 feet deep. This part of the valley was presumably excavated by a waterfall that originated near Fort Snelling at the junction of the tributary Mississippi and Glacial River Warren in whose valley the present Minnesota River flows. The falls have subsequently migrated some seven miles upstream to their present location. The length of time involved in this recession of the falls is a point of conjecture.

Various datings of late-glacial events from the Midwest tend to support later calculations regarding the history of the falls; however, some new paleontological evidence disclosed by a recent carbon 14 analysis of the giant fossil beaver *Castoroides ohioensis* permits some interesting refinements of previous interpretations of the age of the valley and are reported here.

DISCUSSION

As noted by Winchell (1879), observations by various individuals as far back as Hennepin (1680) give yearly rates of change of the position of the falls from 4.79 feet to 6.73 feet and totals from 6,276 years to 8,315 years for the entire time required for their recession. During the later stages, after the falls had entered the rapids at Nicollet Island, the rate apparently increased appreciably due to the "beveling off" of the Platteville limestone, which formed the scarp of the falls in overlying a rather friable layer - the Saint Peter sandstone. Winchell (1879) calculated a 40% increase in the rate of recession during the last stages of development.

Prior to entering the rapids, however, the rate of recession of the falls was uniform as explained by Sardeson (1916). He accounts for the constant rate by the relatively uniform thickness and hardness of the limestone layer throughout the length of the gorge. Other "elements of error" in his calculations are taken into consideration by Sardeson and are satisfactorily disposed of.

It has been estimated that recession occurred in this section of the river at 2.44 feet per year or one mile in 2,163 years and that the falls have been in existence for more than 12,000 years. Later estimates by Sardeson (1932) suggest about 14,000 to 15,000 years for the age of the falls. It is further stated that recession of the falls was in part contemporaneous with the deepening of the Minnesota Valley by the River Warren and in part subsequent to the subsidence of that stream. Measurements show, Sardeson (1932), that when the falls were in the vicinity of the Lake Street Bridge, they were at maximum height of 75 feet. Subsidence of River Warren is demonstrated by the deep channel that was developed in the Mississippi Valley below the Lake Street Bridge. This stretch of the channel was partially filled as the Mississippi became the major drainage when River Warren abated. The distance between the present falls and this point is about four miles; therefore, the time, according to Sardeson (1932), for the end of River Warren was between 8,000 and 9,000 years ago.

Assuming a relatively constant rate of recession for the falls, the following calculations and conclusions, regarding the time of entombment of the skeleton of *Castorioides* within the excavated segment of the valley and the rate at which the falls might have moved, are made:

Materials	100 + grams of bone from mounted skeleton of <i>Castorioides ohioensis</i> SMVP 62-2001.
Locality	Talus slope within Mississippi River gorge, S.E. ¼ Sec. 17 T 28N., R23W. Ramsey County, Minnesota.
Age determination	Post Pleistocene $10,320 \pm 250$ C ¹⁴ B.P.
Remarks	This date is based upon the Libby half-life (5,570 years) for C ¹⁴ . The error stated is $\pm 1\sigma$ as judged by the analytical data alone. The standard is 95% of the activity of N.B.S. Oxalic Acid.
	Recovery of collagen (bone protein) was of good quality for this specimen.

A skeleton of *Castoroides ohioensis* SMVP 62-2001, described by Erickson (1962), was located in 1938 by WPA workers near the bottom of the Mississippi River gorge, where it had been buried beneath talus blocks of Platteville limestone. The nature of preservation and the position within the valley clearly show that the falls had already passed this point on the stream. There is also evidence that the falls were not far beyond this point. A calcareous coating on the bones is mentioned by Powell (1948) as being relevant to the position of the falls. This calcified clay layer on the skeleton is attributed to a moist condition such as would exist at a level in close proximity to the foot of a waterfall - if not part of the major falls, then a subsidiary fall that derived water from the nearby terrace level above the main falls. Position of the specimen is sufficiently high above the lower stream level to prohibit flooding, thus, eliminating this as cause of the moist condition at the level of the skeleton.

An age determination of $10,320 \pm 250$ years for the beaver skeleton serves as a convenient reference within the valley proper. If the rate of retreat of the falls was as previously described, the falls would have reached the site of the skeleton around 14,000 years ago - a figure in marked disagreement with present thoughts. (It is believed that the falls reached this point only as recently as 10,000 years ago.)

With two points of fixed date - Hennepin's sighting in 1680 and the "new" point, with a distance between the two of approximately 6.3 miles - we derive a rate of recession of approximately one mile per 1,580 years. Extrapolating, then, for the remainder of the valley below the skeleton site, gives a total slightly over 11,000 years for development of the entire gorge. The gorge is about 7 miles long from its mouth to the place where the falls were first recorded. It would appear that River Warren subsided about 6,320 years ago, only about two-thirds as long as some other dates proposed. These suggested new dates for events in the development of the gorge would appear to be the youngest possible.

In summarizing it should be noted again that all conclusions reached here are based on the premise that the falls were in the immediate vicinity of the location of the skeleton of *Castoroides* something like 10,000 years ago and moved upstream at a relatively constant rate, at least to the foot of the rapids at Nicollet Island. If indeed the falls were at the site of the beaver skeleton as long ago as 14,000 years, the gorge itself would have had its initiation over 16,000 years ago. The date for the end of River Warren has been previously determined at between 8,000 and 9,000 years, a time when the falls were not yet halfway between their origin and their present

location; therefore, a period approaching twice this has been proposed for excavation of the entire valley. By the same reasoning, the current contention is that River Warren began its decline little more than 6,000 years ago - this being close to one half of the total time involved in the excavation of the complete channel attributed to Saint Anthony Falls. It is quite within the realm of probability that River Warren, especially as far south as the region of the Mississippi junction, began its subsidence before its source, Lake Agassiz, had its total drainage diverted to the east, perhaps between 7,000 and 8,000 years ago.

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